Confidential

Maritime Levy Allocation Recommendation

Report to Maritime NZ

Updated October 2018

Acronyms and Abbreviations

DWT	Deadweight Tonnage
EEZ	Exclusive Economic Zone
GT	Gross Tonnage
MNZ	Maritime New Zealand
Pax Cap	Passenger Capacity
SOLAS	Safety of Life at Sea
The Levy	The Maritime Levy

Table of Contents

Appendices

Tables

Figures

Executive Summary

Maritime New Zealand (MNZ) is reviewing the Maritime Levy (the Levy) as part of the 6-yearly Funding Review. The Levy applies to domestic and foreign commercial vessels operating in New Zealand waters. It forms a significant proportion of MNZ's funding and is used to fund regulatory functions critical to vessel safety, security and marine environment protection.

Over several years there have been various concerns raised by the maritime industry over the methodology used to determine the Levy rates. MNZ has engaged Castalia to provide a recommendation and justification for a revised Levy allocation methodology.

MNZ require a Levy methodology that meets several requirements. The methodology must be:

- Capable of raising the funds required to cover the Levy's areas of responsibility
- Simple and low cost to administer
- Fair, robust, and transparent.

We propose a methodology of charging each commercial vessel based on the estimated risk it brings to the maritime system

Vessels will be levied based on the value of what is being placed at risk by each vessel within the MNZ domain of responsibility, and weighted by how long the exposure is for, and how far away the vessel travels.

The recommended methodology proposes to charge vessels based on three factors that increase the value of what is placed at risk: their size, their freight, and the number of people they are carrying. As each of these factors increase so too does the levy liability.

The recommended method applies three charges to all applicable vessels:

- A rate per Gross Tonne (GT) or for vessels under 24m where GT is not required, Length (m)
- A rate per Passenger Capacity (Pax Cap)
- A rate per Dead Weight Tonne (DWT)

The recommended method defines four categories that weight the charges based on how long they are likely to generate risk for, and how far they are likely to travel from the shore. The rates are applied at different levels to four categories of vessels:

- Foreign Passenger
- Foreign Non-passenger
- Domestic SOLAS
- Domestic non-SOLAS

The factors were chosen after assessing alignment with risk and practicality of administering the charge

Risk is measured as a combination of impact, the potential effect of an incident (which in this case is the value of everything placed at risk), and likelihood, the chance of the event occurring (which in this case is an unmitigated rating for the time and distance travelled by a vessel category). We assessed all the practical vessel characteristics that could be used as a proxy to measure risk. From this range of options, we identified the best based on their

alignment with either impact risk or likelihood risk, as well as their practicality in terms of implementation and ongoing administration.

The monetary value of what is put at risk is assessed for each variable and levy rates are aligned accordingly

The value of cargo, the value of shipping itself, and the risk to life and injury, along with indicators of time and distance at sea can all be quantified for a given year and fleet using a forecast of activity. The relative total value placed at risk informs the amount that each charge (DT or length, Pax Cap and DWT) should raise from the sector.

The concept of the value of what is at risk in the maritime system, measured by the monetary value of what is placed at risk, is not strictly comparable with other concepts of risk. It is not, for example, attempting to measure risk or safety based on data of actual events. The regulatory system, over time and in total has in fact reduced the risks brought about by vessels. We are using the concept of what is placed at risk to represent a measure of 'unmitigated' risk rather than the risk that might empirically exist.

The percentage that each charge should raise for each category of vessel using this approach is shown in the Table ES.1 below:

Table ES.1: Vessel Category Percentages of the Overall Levy Budget

	GT/m	Pax Cap	DWT	Total
Domestic non-SOLAS	4.05%	2.12%	0.00%	6.17%
Domestic SOLAS	4.14%	0.44%	0.21%	4.78%
Foreign Non-Passenger	60.68%	0.00%	6.02%	66.71%
Foreign Passenger	15.10%	7.13%	0.11%	22.34%
Total	**82.64%**	**9.69%**	**6.34%**	**100.00%**

Exact Levy rates are calculated based on the Levy's required revenue

For the sake of demonstrating this methodology we used a required Levy revenue target of $32 million. To keep consistency across vessels, all vessels under 24m will be charged by the metre, and all vessels 24m and over will be charged based on GT.

We use the category percentages and the quantity estimates to calculate example per unit Levy rates in Table ES.2 below.

Table ES.2: Levy Rates Per Unit for $32 million Budget

	Category	GT/m	Pax Cap	DWT
Annual	Domestic non-SOLAS (<24m)	$13.84 (m)	$15.86	-
	Domestic non-SOLAS (>24m)	$7.43		
	Domestic SOLAS	$7.04	$42.22	42 cents
Per Port	Foreign Non-Passenger	10.65 cents	-	0.86 cents
	Foreign Passenger	9.08 cents	$1.83	0.74 cents

Each of the relevant Levy rates are charged to each vessel to produce the overall vessel charge

Vessels are liable for all relevant charges (e.g. GT/m, Pax Cap and DWT), and doesn't differ depending on the vessel type, which is a difference with the current methodology. The proposed methodology achieves the requirements of being simple, transparent, and capable of raising the required revenue. It is based on a methodology that makes it relatively easy to determine per unit Levy rates when the overall Levy budget changes. It also provides a consistent and transparent methodology for why rates are set as they are between activities, classes and vessels, both domestic and foreign. The Levy rates may change depending on the revenue requirements and activity forecast, as they are reviewed, while the methodology for determining relative rates will remain the same.

There are some limitations and challenges associated with the proposed methodology

Determining a risk proxy for all vessels that perfectly aligns with either impact risk or likelihood risk is not practically possible, because there are always going to be different risk factors between vessels that are not feasible to measure cost-effectively. This is not a drawback as it is inefficient to expend large amounts of levy revenue on administration and compliance costs. The methodology, like all Levy methodologies, also relies on forecasts of vessel numbers, size, type and activity.

Some Maritime sub-sectors will see significant changes in their rates. This will particularly affect domestic vessels with high passenger capacities that were previously only charged on GT or metre.

1 Background of the Levy and this Review

The Maritime Levy (the Levy), previously known as the Maritime Safety Charge, is levied by the New Zealand government on commercial maritime operators in New Zealand, including domestic vessels and foreign vessels visiting New Zealand, to fund maritime safety, security and marine environment protection.

Collecting levies to help fund aids to maritime safety was one of the key reasons why a bespoke regulator for the maritime industry was originally set-up in New Zealand. Going back as far as 1862, the Marine Board of New Zealand was one of New Zealand's first government agencies, set-up to collect levies to help fund the construction of lighthouses. Although maritime regulation has gone through various phases since then, some form of national regulation has always existed with the primary purpose of aiding ship safety, and minimising risk.

The current Levy makes up a significant proportion of MNZ's budget, allowing it to maintain functions crucial to the safety, security and cleanliness of the maritime industry. The Levy rates are required to be reviewed every 6 years, with mid-point reviews every 3 years. The previous mid-term review took place in 2015/16 and involved fee adjustments, however the methodology and structure of the Levy model have not been fully revised since 2008.

Castalia has been commissioned to provide a specific methodology recommendation for raising the Levy to serve as an input to the MNZ 2018/19 Funding Review. Our recommendations in this paper aim to identify the best way to raise the Levy, including who to charge, and how much to charge.

The overall goal is to recommend a methodology which will meet the cost of activities required to be funded by the Levy, be efficient, effective, low cost to administer, transparent, and based on a fair and consistent logic.

1.1 Objectives of the Levy

The Levy is the primary means by which MNZ maintains the maritime regulatory system that is critical to vessel safety, security and cleanliness. It is designed to pay for functions that are not funded by the Crown, and where it is not feasible or desirable to measure and charge for individual usage. It applies to all commercial operators even if they do not 'use' the functions it funds in any given period. These functions currently include, but may not be limited to:

- Aids to navigation, including lighthouses, beacons, and buoys
- Maintaining and monitoring the distress and safety radio network for New Zealand's coastal waters and the South Pacific
- Investigation of maritime accidents and prosecutions
- Negotiation and maintenance of international agreements
- Improving maritime safety education and awareness among vessel operators
- Any other functions provided, or any regulatory activities undertaken, by the Authority, the Director, the Maritime Appeal Authority, or the Crown in the performance or exercise of functions, duties, or powers under the Maritime Transport Act.

The Levy accounts for approximately 39 percent of MNZ funding, which also includes Crown funding, revenue from direct fees and charges and funding through other levies

such as the Oil Pollution Levy, Health and Safety at Work Levy and Fuel Excise Duty (contribution from the fuel excise duty on petrol paid by recreational boaties).[1]

1.2 Market Activity in the Maritime Sector

The New Zealand Maritime industry has an annual turnover of $1.6 billion. The industry is made up of several sectors:

- **Foreign Freight Shipping**—foreign flagged freight vessels that transport exports and imports with an estimated value of $83.6 billion. 99 percent of New Zealand trade occurs by shipping with approximately 960 foreign ships visiting New Zealand in 2017/18.
- **Foreign Cruise**—a rapidly growing industry, with over 40 different cruise ships visiting New Zealand in 2017/18 and a trend towards larger vessels. Ovation of the Seas, for example, the largest cruise ship to visit New Zealand, has a passenger capacity of 4,180 (the largest cruise ship in the world, Harmony of the Seas, has a passenger capacity is 6,780).
- **Domestic Coastal Shipping**—moves 4 million tonnes of freight per annum and accounts for 15 percent of total New Zealand freight. Made up of approximately 13 vessels including the five Cook Strait crossing ferries.
- **Domestic Fishing**—over 1,500 certified domestic commercial fishing vessels. Seafood is one of New Zealand's largest export industries, earning over $1.79 billion in 2016.
- **Domestic Passenger**—Passenger ferries were dominated by Auckland ferry boarding's which totalled 6.2 million for the 12 months to December 2017. The industry also includes water taxies, tourist cruises and charter boats and is made up of over 100 vessels.
- **Domestic Non-Passenger**—a diverse range of vessels such as tugs, pilot vessels, tankers, barges and research vessels.
- **Domestic Outdoor and Adventure**—a relatively new industry that is now a major contributor to the tourism industry, including jet boats and white-water rafts.

The Levy allocation methodology is required to find a fair and impartial way to assign rates across all of these diverse sectors.

2 How Does the Current Levy Work?

The current Levy allocation model operates using a range of different charges, and vessels are liable for just one of the charges, depending on their assigned category. The Levy system, including the current methodology, charges, how it affects the various sectors, and any limitations, are discussed below.

2.1 How the Charges Are Assigned

The current Levy separates vessels into seven different categories which have different measurement variables and rates. These are:

- Foreign Vessels (charged per port visit)

[1] Based on 2018/19 Budgeted figures, source: Maritime New Zealand)

  - Passenger—based on passenger capacity (Pax Cap)
  - Non-passenger—based on deadweight tonnage (DWT), with one rate for first port visit, and a lower rate for subsequent visits. There are also different rates for vessels with and without summer load lines, although the reasoning behind this is unclear.

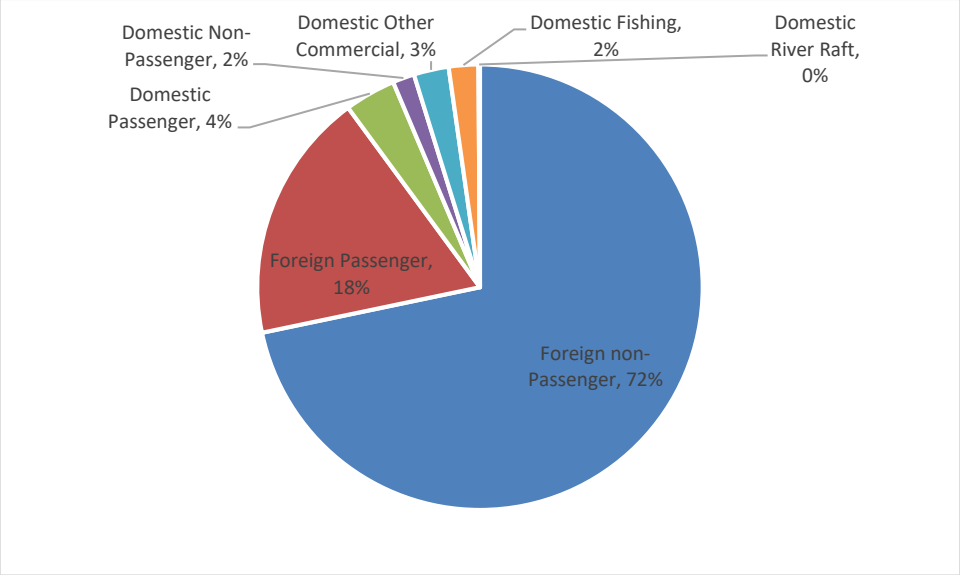
- Domestic Vessels (charged annually)
  - Fishing—based on the higher calculated sum of per metre or per gross tonne (GT)
  - Passenger—based on Pax Cap. Defined as commercial vessels with a capacity of more than 12 people, that are 45 metres or more in length and proceed beyond restricted limits or travel internationally. These are predominantly vessels that are signees of the International Safety of Life at Sea (SOLAS) convention, and currently only applies to five Cook Strait ferries.
  - Non-passenger—based on DWT. Defined as a commercial vessel of 45 metres or more in length that proceeds beyond restricted limits, but is not a passenger vessel or a fishing vessel. Predominantly SOLAS vessels. Currently ten vessels fall into this class.
  - Other commercial vessels—based on the higher calculated sum of per metre length, per GT, or per DWT.
  - Commercial river raft—based on the higher calculated sum of per metre length or per GT.

2.2 Revenue Raised

The Levy raised $17.8 million in 2014/2015 and 2015/2016, approximately $20 million in 2016/2017 and $21.2 million in 2017/2018.

Figure 2.1 shows the 2017/18 breakdown of revenue across the seven categories currently defined in the Levy. (Note that the charges to the commercial river rafting category are too low to register on the pie chart as a percentage to one decimal place)

Figure 2.1: Maritime Levy Revenue by Category, 2017/2018



2.3 Current Levy Performance

The current Levy is successful in raising budgeted revenue. It is also a relatively similar structure to other international maritime levies, such as the Australian Marine Navigation Levy, that is paid quarterly by Australian coastal trading vessels, and per port visit for international trading vessels, and charged on a net tonnage basis.

The current variables that the Levy bases its charges on are relatively simple to administer as they are categories required to be declared when registering a commercial vessel or are generally available for vessels where registration is not required. They also do not require extensive monitoring, such as attempting to record time spent on the water or total passengers carried.

Limitations of the current approach

The allocation of the Levy charges is, however, sometimes inconsistent, comprising a mix based on data collection, risk and cost methodology. The reasoning behind how the charges were set also lacks some transparency, as there is no readily available information that describes why rates are set differently. For example, lower rates for fishing vessels, and different rates for foreign freight vessels with and without summer load lines. The current structure also has foreign passenger vessels paying the same rate for every port they visit in New Zealand, whilst foreign freight vessels have one rate for the first port they visit and a different rate for subsequent ports. This methodology can appear to be anomalous, even if there was reasoning behind the decisions at the time.

The different rates and perceived charging anomalies have led certain sectors within the maritime industry to claim that the Levy is inequitably allocated. An example of a specific anomaly is between domestic SOLAS passenger vessels and domestic non-SOLAS passenger vessels, which simply fall under the 'Other Commercial' category.

The Kaitaki Interislander is a domestic SOLAS vessel that has a Pax Cap of 1,350 and was charged $321,489 per annum based on a Pax Cap rate of $238.14 per passenger. The Auckland Harbour passenger ferry Superflyte, has a Pax Cap of 651, and was charged $2,970 based on GT, equating to a Pax Cap charge of just $4.56. These different rates have

a logic behind them, but they have been built in isolation from each other, making it difficult to justify from a fairness and equity perspective.

3 What are the Recommended Charges?

The first step in designing a revised Levy allocation methodology is to ask the fundamental question of who the Levy aims to charge and how these groups can be defined. From this, the structure and rationale of how to allocate the Levy can be designed, and finally the charges determined.

3.1 Who Do We Levy?

The New Zealand Treasury provides detailed guidelines on determining who to charge for public services[2], which we have followed here. First, the advice contrasts a fee and a levy. A fee being a stated payment in return for a clearly defined good or service, and a levy being charged for an overall purpose, but not a specific service, such as the Maritime Levy.

Levy funded functions can be categorised as public goods, private goods, club goods, or merit goods. Each of these types of goods have different charging options associated with them. We have assessed the Maritime Levy functions and categorised them as club goods, largely because individual 'consumption' does not detract from the amount available for others or alter the cost of provision in general. A Levy is a good charging option for club goods.

In contrast, a fee is an appropriate charging mechanism for private goods such as the certification and training functions undertaken at MNZ (which are funded by fees). Public goods are best funded by general taxation such as the various functions undertaken at MNZ with Crown funding.

Members of the 'club' should be liable for the Levy. In this case the club includes all of the commercial maritime sector, including those subject to regulatory and compliance functions, who have access to safety communications and aids to navigation, or who interact directly or indirectly with international aspects of regulation.

Each of these regulatory functions would still be required in the absence of a single subsector. This makes it challenging to assign functions between subsectors and create smaller 'clubs'.

3.2 What Do We Base the Levy On?

The group that is liable for the Levy is defined in the Levy regulations as the entire commercial sector, however, this is not in itself sufficient insight to allocate charges to each vessel. The next step is to determine on what basis we assign the different charges to individual vessels. There are several approaches that can be applied when assessing how to allocate cost recovery between vessels. The approaches can be summarised as either charging:

- *Cost exacerbators* (vessels that are deemed to cause cost to be incurred are levied on that basis)
- *Beneficiaries* (vessels that are deemed to be benefitting from the regulatory functions are levied on that basis)
- *Risk exacerbators* (vessels that are deemed to bring risk to the system are levied on that basis)

[2] NZ Treasury Guidelines for Setting Charges in the Public Sector, April 2017

A combination of the three approaches can also be applied.

Options to impose the levy on who drives cost into the regulatory system

Identifying who the direct cost exacerbators are, for regulatory activities that are club goods, can be difficult. It is not consumption of the club goods that necessarily drives the costs. These club goods are not recoverable from fees. Typically, when a direct cost exacerbator, or specific beneficiary, can be identified then fees are charged. An example of this is the MOSS and SeaCert fee regimes introduced under regulations in early 2014.

If subsectors can be identified within the commercial sector, which exclusively require particular activities to be undertaken, it implies that those activities should be recovered from those subsectors. However, our analysis has not identified particular subsectors who exclusively generate the need for particular activities. All commercial subsectors require compliance functions, safety communications, and aids to navigation.

All commercial participants can be thought of as indirect cost exacerbators as they introduce risk into the system through their activities and this risk drives the need for regulatory activities. This suggests that a measure of the activity undertaken, and the risk introduced as a result of the activity, would best reflect the regulatory cost drivers in the sector.

Options to impose the levy based on who benefits from the regulatory system

The commercial participants in the maritime sector are the immediate beneficiaries of a safe, secure and clean, regulated commercial sector. There are also subsequent benefits to the wider economy as a result of a safe, secure and clean, well-functioning commercial maritime sector, principally through trade and transport services and marine environment protection.

The Levy model is principally concerned with identifying beneficiaries within the commercial sector. Identifying direct or specific beneficiaries within the commercial sector from particular activities is sometimes possible—such as a call to a distress radio. However, this is not always possible across the full range of activities, for example, who might have benefited from a remote aid to navigation. It can also be somewhat misleading as the beneficiaries of a distress radio system are all participants, even though they might not ever need it, as it reduces the consequence risk they face, even if the incident never happens.

The beneficiaries of the commercial sector could potentially be assessed based on the commercial reward they receive, for example, the profit or the revenue that is generated relative to other participants reflects the relative commercial benefit that is ultimately received. However, this information is not generally disclosed and may be volatile even if it was.

Assigning the Levy based on risk that a vessel brings to the maritime system is the most appropriate option in this case

Assessing risk precisely for each vessel (in a way that also accounts for behavioural risk factors) is not practically feasible, however, there are several proxies that can be used to represent the proportional level of risk that each vessel is bringing to the maritime system. This allows a consistent basis to be used for all the characteristics and different activities that each participant engages in within the sector. These proxies can be made up of measures that are both readily available and their relationship with risk in the system can be shown.

Risk can be defined as the combination of impact, the potential effect of an event, and likelihood, the chance of the event occurring. The key risk that is being assessed here is the risk of threatening safety in the maritime environment, and the potential flow on effects

from that. This could include injuries or fatalities, damage to vessels, freight or coastal infrastructure, and harm to the marine environment.

Using a risk proportional levy methodology provides a set of specific fees for each activity

The important step in this method is to measure total risk incurred from each activity using a common measure, such as the monetary value of what is placed at risk by the activity. One option is to then set revenue requirements from each risk measure according to the total relative risk exposure that the activity brings to the system. This method allows us to use a relative measure of risk to assign charges based on a target revenue to be recovered from each activity. A fee level for each activity is consistent between activities for the risk imposed.

We can now identify the most suitable risk measures to charge for and the proportions of relative risk that are appropriate.

3.3 What Risks Should be Charged For?

The overall risk of each participant, or vessel, is made up of a combination of its unique characteristics. At the broadest level, this can be broken down into characteristics of the vessel itself, what it is doing, and where it is going.

Various risk exacerbators related to these categories can be identified. The potential measures of these risk factors can then be assessed on their ability to align with risk likelihood and impact. Risk alignment must also be weighed up against the potential cost or difficulty associated with implementation and the ongoing administration of collecting the data associated with each measure.

We conducted an analysis that collected these factors and assigned them a numerical rating of 0 - 3 based on their ability to align with risk, and an assessment of how easy it would be to implement (for example, how would the data be collected and collated, and how much would it cost?). These ratings were combined into a total rating, with a higher number representing a more appropriate measure. The table that collates these results can be found in 6.2Appendix AAppendix A.

Based on this analysis, and perhaps unsurprisingly, the factors that resulted in the highest ratings, are predominantly the variables on which the Levy is already charged. This is due to the difficulty of collecting measures that are more closely aligned to risk, such as actual hours on water, or the exact number of people on board.

Six variables received the highest rating of six or seven out of nine:

- Gross Tonnage / Length
- Passenger Capacity
- Deadweight Tonnage
- Domestic vs Foreign Vessels
- SOLAS vs non-SOLAS Vessels
- Port Visits (foreign vessels)

Gross Tonnage/Length

Gross tonnage (GT) and length are impact variables. They align with impact as a larger vessel is likely to cause more harm and damage (including to itself). This could be in the form of injuries to people, loss or damage to the vessel, damage to other vessels,

infrastructure (such as a wharves, piers or gangways) or the natural environment. The fact that either GT or length in metres for vessels under 24m are currently collected means there would be no added cost in using this as a Levy variable.

Passenger Capacity

Passenger capacity (Pax Cap) is an impact variable. People carried on board a vessel has the potentially very serious impact of injuries or fatalities. There is no current way to get specific data on the exact number of people being carried on a vessel. It would also mean charging in hindsight, rather than at the start of the year for domestic vessels. However, the vessel Pax Cap is a very good indication of how many people are likely to be travelling on a vessel in addition to the vessel crew.

Deadweight tonnage

Deadweight tonnage (DWT) is an impact variable. DWT is a measure of how much mass a ship can carry. It is generally used as a measure of freight being carried. The impact of freight includes both the financial value of the freight and the potential damage that lost freight could cause, directly and indirectly, including impact on the marine environment.

Domestic vs. Foreign Vessels

Different rates between domestic and foreign vessels is a likelihood variable. It is an indication of distance from shore, as all foreign vessels must travel all the way from the edge of our offshore limits, whilst most domestic vessels will operate close to shore.

SOLAS vessels (and non-SOLAS that meet exceptions)

Whether a domestic vessel is registered as SOLAS or not is also a likelihood variable. SOLAS vessels are registered to proceed beyond restricted limits, thereby increasing the likelihood of them operating in more dangerous waters that are difficult to access. Foreign flagged vessels can operate in New Zealand under SOLAS rules also.

Port visits (foreign vessels)

Port visits is a likelihood variable, but is only applicable to foreign vessels. It is a good indication of how long a foreign vessel spends in New Zealand. The longer a vessel is here, the more the likelihood of an incident increases. Foreign vessels are currently charged on a per port basis, so this does not add any extra administrative costs that are not already incurred.

3.4 How Do We Assign Risk?

The impact risk variables identified above are cumulative risk factors that each independently increase risk. Therefore, rather than choosing just one variable to base a vessel's rate on, each variable can be used to produce a combined overall vessel charge that increases risk alignment.

This model of combining impact variables to represent an overall charge, allows for a closer alignment with risk. For example, a large vessel built to carry freight, compared to a smaller vessel designed to carry people. Previously, with charges based entirely on GT for domestic commercial vessels, the smaller passenger vessel would pay a lower charge, that does not accurately represent the additional risk that carrying passengers brings to the sector.

Impact risk charges

All vessels will be required to pay a GT or length charge. All vessels certified to carry passengers will also pay a charge based on their Pax Cap to represent the significant additional risk this adds. DWT is typically only a measure for vessels that carry freight, so

would be an additional charge on top of GT for freight vessels, to represent the additional risk this adds.

Likelihood risk charges

The key likelihood variable is the distinction between domestic and foreign vessels, which is used as an indicator of where the vessel is travelling. This is further broken down amongst domestic vessels by having a distinction between SOLAS and non-SOLAS vessels, to represent the increased likelihood of the vessel travelling beyond restricted limits.

The likelihood variable for time spent on the water can be represented for foreign vessels by the number of ports visits, which is used to approximate how many days the vessel spends in the country.

No suitable measure to represent time spent on the water was identified for domestic vessels that did not add substantial administrative time and costs. Therefore, we propose keeping the current method of an annual charge. There is provision in the Maritime Levies Regulations to refund or waiver fees paid on an annual basis if the vessel is out of commission or laid up for repairs for three consecutive months or more.

4 How Much to Charge?

We can now determine a methodology to calculate the Levy rates for each of the recommended variables.

The rate of each charge should be set relative to the other charges for the level of risk imposed

To compare the relative risk that each measure brings to the system we propose using a comparative measure to assess what is placed at risk. The purpose of this step in the methodology is to formulate a consistent and comparable rate for each of the proposed charges.

4.1 Assessing the Impact Risk

The impact risk factor of each variable can be determined by assigning them a monetary value. By using the common measure of money, we can fairly assess how each of the variables compares to each other in terms of the risk they bring to the maritime system. For example, losing a life can be statistically compared to losing a freight container by using monetary estimates of the willingness to pay to avoid injury and the value of the freight lost. This can then be used to assign each variable a risk factor ratio.

What value does Gross Tonnage/Length represent?

For this purpose, the economic value of a GT per vessel is used and made up of three key factors:

- The potential cost to the vessel—an estimation was determined from the average cost of building a vessel taken from a variety of vessel types and sizes per GT **($6,239)**
- The potential cost of injury to the crew—using the value determined per Pax Cap (as discussed in the next section), combined with an average ratio of the number of crew per GT (a different ratio is used for small and large vessels, as the number of crew does not continue to increase at a consistent rate with vessel size) **($8,390-$62,867)**

- The potential cost to infrastructure and the environment— using an estimation of the average maritime accident response cost to the environmental impact of a vessel colliding, running aground, sinking and leaving debris etc[3] **($15,500)**

The value of the GT can then be used as a proxy for the value per metre, which is based on the average ratio between length and GT calculated using vessels under 24m that have reported both measures. Based on a sample of 592 vessels the average ratio was **1.86** GTs per metre for vessels under 24m.

What value does Passenger Capacity represent?

The value per Pax Cap has been determined by 5 key factors

- The Value of Statistical Life (VOSL)—**$3.85 million**[4]
- The valuation of risks of non-fatal injuries using a fraction of the VOSL[5]—1 fatality to 10 major injuries (**$385,000**) to 200 minor injuries **($19,250**)[6]
- An average ratio between fatalities, major injuries and minor injuries in maritime accidents—based on an average of an American and Australian sample[7] (the NZ sample is too small), 4.25 major injuries and 10.5 minor injuries to every fatality
- The value that the Pax Cap figure represents of the average number of passengers that would typically be travelling on a vessel—based on an assumption that domestic vessels carry on average of **50 percent** of their Pax Cap and foreign cruise vessel and average of **80 percent**.
- The value that the Pax Cap figure represents of the average number of crew on the vessel—Pax Cap was determined to only be a representative proxy for the number of crew on board a vessel for foreign cruise vessels which have a particularly high crew to passenger ratio due to their large number of hospitality staff. The average crew to passenger ratio was taken from 22 foreign cruise ships and found to be **0.41**.

By combining the injury ratios with their associated statistical values, and we can calculate an overall value of **$361,167** per person per maritime accident.[8]

What value does Deadweight Tonnage represent?

The value of a DWT is made up of two key factors:

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[3] Methods to Quantify Maritime Accidents for Risk-based decision making, EfficienSea, 2012 (using the midway point between the average estimate of $13,000-$19,000 per tonne.

[4] Treasury Guide to Social Cost Benefit Analysis July 2015: https://treasury.govt.nz/sites/default/files/2015-07/cba-guide-jul15.pdf

[5] International literature supports the valuation of risks of non-fatal injuries by using a fraction of the statistical value of life: Approaches to Valuing Injuring and Mortality Risk in Transport Assessments, New Zealand Institute of Economic Research, 2015; https://www.nzta.govt.nz/assets/resources/research/reports/571/docs/571.pdf

[6] The Weighting of Non-Fatal Injuries, Rail Safety and Standards Board, 2008

[7] https://americanboating.org/boating_fatality.asp; Australian Shipping Occurrence Statistics 2005 to 2012, Australian Transport Safety Bureau; https://www.atsb.gov.au/media/4119146/mr-2013-002_final.pdf

[8] (1 x $3,500,000) + (4.25 x $335,000) + (10.5 x $16,750) = $4,949,625. This is then divided by the sum of the multipliers (15.75) to give a total of $314,261.90

- The average value being carried in a DWT—based on the total value and quantity of imports and exports by sea to New Zealand from Statistics NZ data from 2015-2017[9] **($1,406)**
- The average financial cost of the container itself— based on an average of regular and refrigerated reefer containers and approximately 20 tonnes per container **($375)**

4.2 Assessing the Likelihood Risk

We also need to quantify the likelihood of an incident to combine with the impact of an incident, to get a suitable overall measure of risk for each vessel. Quantifying the chosen likelihood variables presents more challenges than impact variables. However, a multiplier for how much a certain activity increases risk can be determined to assign relative risk ratios.

The likelihood of increasing the chance of a maritime incident can be broken down into at least two readily observable factors; the amount of time the vessel spends on the water, and how far the vessel is likely to be travelling. Other factors, such as directly risky behaviours and decisions are not readily observable, and no information is currently available that would enable such risk rating.

What relative exposure do Domestic vs. Foreign vessels represent?

Differentiating between domestic and foreign vessels can be used as a proxy for how far away the vessels are likely to be travelling. Travelling further from the coast, or in more treacherous waters, increases the likelihood of an incident occurring. All foreign vessels must travel to New Zealand from the edge of our controlled waters. The coastal water limit in New Zealand is 50 nautical miles, and the Exclusive Economic Zone is 200 nautical miles from the coast. This would mean they are typically travelling four times further than our domestic vessels. For this analysis, we have applied a ratio of **4** in proportion to this distance.

What relative exposure does domestic SOLAS vs. non-SOLAS represent?

One indicator we have regarding where domestic vessels travel is whether they are registered as a SOLAS vessel or meet the exceptions that require them to meet the SOLAS safety standards. This indicates they are registered to travel internationally, or beyond restricted limits. Restricted limits are made up of inland waters, sheltered waters and waters closely adjacent to sheltered waters. The Cook Strait is outside of restricted limits, but within the Coastal limit, and is the region of waters that would be regularly frequented by domestic SOLAS vessels. Based on this, if we use a ratio of 1 for vessels predominantly within restricted limits, and 4 for international vessels based on the 200 nautical miles limit, SOLAS vessels operating predominantly within the 50-nautical mile coastal limit would receive a ratio of **2**.

What relative exposure do port visits of Foreign vessels represent?

Foreign vessels can be measured on a per port basis, which provides a good approximation of the amount of time/days spent at sea. Freight vessels visit an average of two ports per trip. Based on an assumption of one-day travel in and out of New Zealand waters, a day at each port, and a day travel between ports, this gives us a ratio of five days to two ports, or **2.5**.

[9] Statistics NZ: http://archive.stats.govt.nz/infoshare/?url=/infoshare/&_ga=2.209700113.2028373782.1530675021-1070439993.1502166713

Foreign cruise ships visit an average of 6 ports. With the same assumptions about travel times in and out of New Zealand waters and between ports, this gives us a ratio of **2.17** days per port.

What relative exposure does an annual charge for domestic vessels represent?

Domestically, data for days spent at sea is not collected, as vessels are charged on an annual basis. Vessel utilisation rates across different sectors would vary greatly, with some vessels operating every day, but many others operating only on weekdays, weekends, or at certain times of the year. In this analysis, we have assumed a domestic non-SOLAS commercial vessel operation rate of 50 percent of time on water. To align this with the foreign vessel measurement of days, we can convert this to **182** days for an annual charge. Domestic SOLAS vessels are more likely to be of a higher commercial intensity than non-SOLAS and therefore we have assigned them an operation rate of two thirds (66 percent), or **243** days. It would be possible to use different utilisation rate for more specific types of vessels; however, this would increase the complexity of the Levy by having different rates for different sectors. However, it remains a viable option to be considered, if reliable data can be obtained that finds consistently significant differences in utilisation across types of vessels that could easily be distinguished into categories for the levy

What are the implied vessel categories from these charges?

The different likelihood ratios for the different categories creates Levy sub-sectors. There is an overall distinction between domestic and foreign. Within foreign vessels there is a differentiation between freight and passenger, and within domestic there is a differentiation between SOLAS and non-SOLAS vessels.

The old Levy categories of New Zealand Fishing, New Zealand Commercial River Rafts and Other New Zealand Commercial ships, will now all fall under the same category of Domestic-non SOLAS.

What are currently referred to in the regulations as New Zealand passenger and non-passenger ships will be combined into the Domestic SOLAS category, whilst foreign vessels maintain the same differentiation of Passenger and non-Passenger.

Having just 4 categories reflects the 4 different categories of rates that will be calculated, but it would be possible to break them down into the current Levy categories when publishing the rates so that no participants are left in doubt.

Table 4.1: Likelihood Risk Ratios

Likelihood Factor	**Domestic non-SOLAS (annual)** (includes New Zealand fishing, New Zealand commercial river raft, and other New Zealand commercial ships)	**Domestic SOLAS (annual)** (includes New Zealand passenger and non-passenger ships)	**Foreign Freight (per port) (includes foreign non-passenger)**	**Foreign Passenger (per port)**
Where Vessel Is Likely to be Travelling	1	2	4	4
Time on Water	182	243	2.5	2.17

Likelihood Risk Ratios	**182**	**486**	**10**	**8.68**

4.3 What Proportion of the Required Revenue is Drawn from Each Category?

To determine the proportion of the revenue that each category will be liable for we use the following information:

- A volume forecast for the activity measures
- The likelihood risk ratios
- The impact risk ratios

When the impact ratios are multiplied by the likelihood ratios we produce a single risk ratio for each variable for each of the four vessel categories (3 impact variables x 4 likelihood variables = 12 unique ratios).

By then using the predicted unit quantity for each category and multiplying it by its category risk ratio we can convert it into a percentage of the overall sum. This percentage represents how much of the overall Levy each category is responsible for raising, based on the risk that it brings to the maritime environment.

We have used quantities from the MNZ 2017/18 dataset.

Table 4.2: Vessel Category Percentages of the Overall Levy Budget

	GT/m	Pax Cap	DWT	Total
Domestic non-SOLAS	4.05%	2.12%	0.00%	6.17%
Domestic SOLAS	4.14%	0.44%	0.21%	4.78%
Foreign Non-Passenger	60.68%	0.00%	6.02%	66.71%
Foreign Passenger	15.10%	7.13%	0.11%	22.34%
Total	**82.64%**	**9.69%**	**6.34%**	**100.00%**

4.4 Individual Levy Rates

To determine the Levy rates for each factor we use the following information:

- A target budget for the Levy
- The category percentages required of the Levy
- The volume forecast for the activity measures

Applying a target Levy budget, allows us to determine the revenue that each category is required to raise. By then dividing this by the same estimated category quantities used the in previous step, we can reach a per unit rate for each category.

The below table shows Levy rates based on a target revenue budget of $32 million.

Table 4.3: Levy Rates Per Unit for $32 million Budget

	Category	GT/m	Pax Cap	DWT
Annual	Domestic non-SOLAS (<24m)	$13.84 (m)	$15.86	-
	Domestic non-SOLAS (>24m)	$7.43		
	Domestic SOLAS	$7.04	$42.22	42 cents
Per Port	Foreign Non-Passenger	10.65 cents	-	0.86 cents
	Foreign Passenger	9.08 cents	$1.83	0.74 cents

These are example rates and will change depending on category quantity and required budget forecasts. However, the methodology remains the same, making it simple to recalculate.

5 How Will the Industry Be Affected?

These recommended charges will have flow on effects to the various subsectors of the maritime industry. This will depend on each vessel's particular activities and may mean an increase or a decrease depending on vessel characteristics.

A significant change with this proposed methodology is that some vessels will go from being charged based on one variable, which depends on their vessel category, to being charged for several variables that are combined to produce a total payment. One effect of this change is that any individual's circumstances are less sensitive to a change in any particular rate (as it implies the others move in the opposite direction to meet the overall revenue requirement).

5.1 New Zealand Vessel Category Comparisons

The proportion of the total Maritime Levy budget raised from foreign vessels vs. domestic vessels under the new methodology remains virtually unchanged, with foreign only dropping from 90 percent to 89 percent.

The largest change in the domestic industry is from the category previously classified as "New Zealand Passenger Ships" which was comprised of only five Cook Strait crossing ferries, yet was previously responsible for 37 percent of the total budget raised from domestic vessels. This category significantly declines in the percentage of the revenue that it is responsible for raising, dropping to 24 percent. A specific example of this is the Interislander ferry Kaitaki which has a GT of 22,365, a Pax Cap of 1,350 and a DWT of 5,794. Under the previous methodology she was charged $321,489 based on the Pax Cap charge of $238.14. Under the proposed methodology, and even with an increased revenue requirement up from approximately $21 million to $32 million, Kaitaki's total Levy charge still declines to $216,967.54.[10]

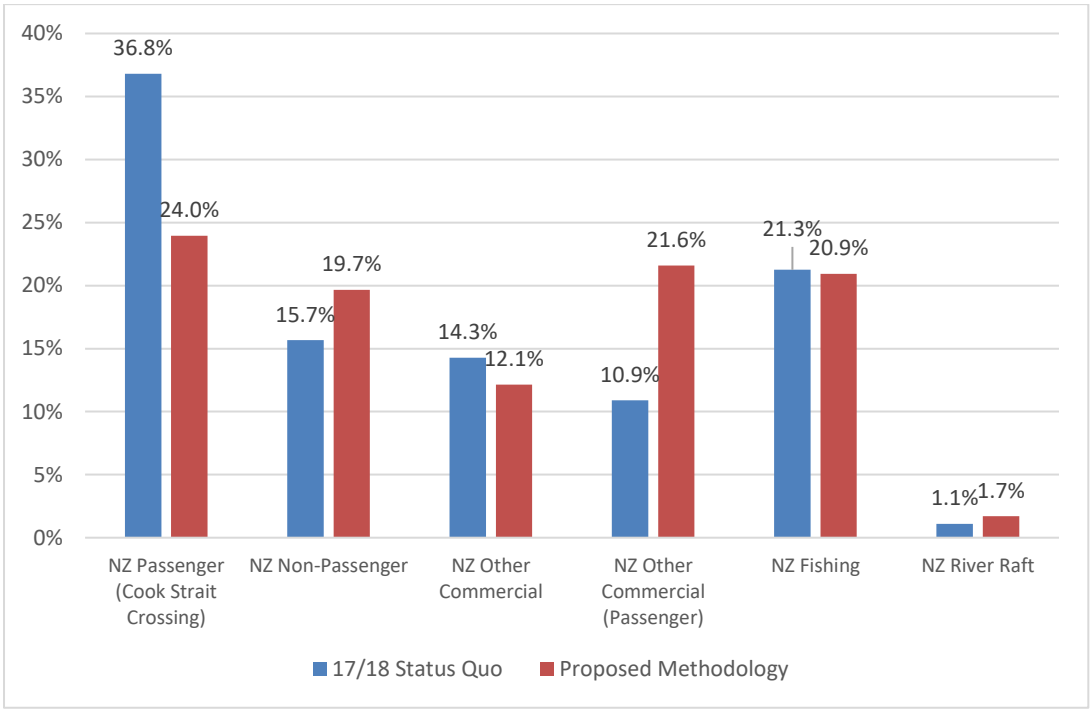
Passenger ships that previously fell under the "Other New Zealand Commercial ships" category rise from raising 11 percent of the domestic Levy budget to 22 percent. The most extreme example of this is the Auckland passenger ferry Kea with a GT of 341 and a Pax Cap of 450. Previously only charged on GT $1,753, she would now receive a cumulative

[10] (22,365 x $7.04 =$157,552.67) +(1,350 x $42.22 =$57,002.03) + (5,794 x $0.42 = $2,412.85)

GT and Pax Cap charge that under the increased $32m revenue would sum to $9,668.19[11] ($6,043 if comparing with raising approximately similar $20m revenue).

Figure 5.1 shows the changes in percentages raised across all domestic vessel categories.

Figure 5.1: Percentage of New Zealand Vessels Levy Budget Categories Raise

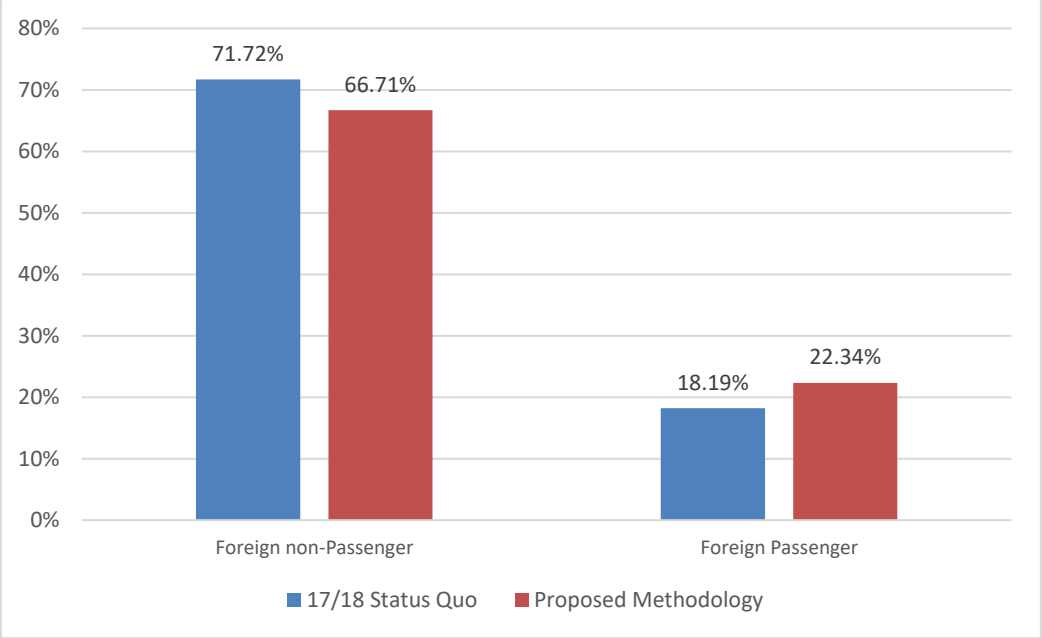


5.2 Foreign Vessel Category Comparisons

Due to the accumulated risk methodology and a greater emphasis on the VOSL, the foreign passenger vessel category increases in the proportion of revenue it is required to raise compared to foreign non-passenger vessels. Figure 5.2 shows the percentage of the total Levy budget that the two foreign vessel categories will be responsible for raising under the new methodology compared to the old.

[11] (341 x 7.43 = 2,533.16) + (450 x $15.86 = $7,135.03)

Figure 5.2: Proportion of Total Levy Budget Foreign Vessel Categories Raise



6 Summary, Limitations and Challenges with the Proposed Approach

The proposed methodology is based on a risk exacerbator approach, meaning we recommend Levying vessels based on the estimated risk that each vessel brings to the MNZ domain of responsibility. This is measured in turn by the monetary value of what is placed at risk by a vessel.

We assessed all the possible vessel variables that could be used to measure risk, and selected the options based on their alignment with impact and 'likelihood' (time spent and how far they are likely to have travelled) risk, and their practicality in terms of implementation and ongoing administration.

The key impact variables were deemed to be:

- Gross Tonnage
- Passenger Capacity
- Deadweight Tonnage

The key time and distance (likelihood) variables were:

- Foreign vs. Domestic
- SOLAS vessels (domestic)
- Port visits (foreign vessels only)

The impact variables were given an approximate monetary value, to determine their relative weighting against each other. The likelihood variables were given a multiplier for how much they were deemed to increase the likelihood of an incident.

This allowed each category to be given an equivalent ratio based on how much risk they bring to the sector, which was used to determine individual Levy rates based on quantity volume and required budget forecasts.

The Levy rates are based on an annual rate for domestic vessels and a per port rate for foreign vessels. Due to some domestic vessels choosing to operate for part of the year, or entering or leaving the operational fleet during the year, it may be desirable to retain the provisions for waivers and refunds that exist in the present regulations. There are precedents for this in the vehicle industry with registration rebates when cars are taken off the road.

6.1 Key Differences from the Current Levy

The key difference from the current Levy structure is that with the proposed methodology the overall vessel charge is cumulatively based on each risk variable. All vessels will have a GT or metre charge, vessels carrying passengers have a Pax Cap charge, and vessels that carry freight will also have a DWT charge. This is compared to the current structure of charging based on just one variable that differs between different classes of vessel.

The newly proposed methodology also reduces the number of vessel categories to just four; Domestic commercial, Domestic SOLAS, Foreign Freight, and Foreign Passenger. This increases simplicity whilst also increasing risk alignment because of the cumulative risk factor approach. However, it would be possible to add additional domestic vessel categories if reliable information showed that there were significant differences between vessel categories in terms of time spent on the water, or distance from shore.

6.2 Limitations of the Proposed Approach

Determining a perfectly aligned risk proxy for all vessels that takes account of specific behavioural risk factors is not practically possible. There are always going to be different risk factors between vessels that are not feasible to measure cost effectively. Therefore, it is important to find a compromise between fair rates and the Levy being administratively simple and transparent.

The 'likelihood' multipliers, which only try to measure time and distance, of different vessels to are the hardest to estimate due to the administrative challenges associated with collecting well aligned domestic vessel information regarding where and for how long vessels are travelling.

The proposed methodology relies on forecasts of the vessel category quantities, for example, the estimated total DWT of foreign freight vessels. If these quantities are significantly different from the actual quantities, the income from the Levy could become misaligned from the required budget. This would, under the current arrangements, only be able to be corrected every 3 years at the interim funding review. However, this issue is always going to be a consideration, no matter what methodology is used.

It is our view that, despite some potential challenges, this cumulative risk-based approach is the most consistent and robust way to apply the Maritime Levy. Other approaches necessarily rely on arbitrary allocations, whilst this methodology provides a consistent and justifiable foundation.

Appendix A: Rating of Potential Levy Charge Measures

Table 6.1: Rating of Potential Levy Charge Measures

Risk Factor	Possible Measures	Risk Alignment (0,1,2,3)		Ease of implement-ation (3 good, 1 bad)	Total Score
		Likelihood	Impact		
Size of vessel	Gross Tonnage	**1** Low relationship to possibility of an incident	**3** The larger the vessel, the larger the potential impact	**3** Already collected	**7**
	Length	**1** Same as above	**3**	**3**	**7**
Age of vessel	Surcharge for vessels over certain age	**2** An older vessel may be more likely to be involved in an incident	**0** Age has no relationship to the impact of an incident	**2** Should be relatively easy to collect, when vessels are registered	**4**
Type of vessel	Different rates/surcharges for different vessel types, e.g. yachts, jet boats, barges, ferries.	**1** There is no direct relationship between type of vessel and incidents – all vessels can be involved, and basing it on historical data does not necessarily predict future occurrences	**2** Certain types of vessels, particularly larger in size, could be related to impact	**2** Relatively easy to collect – but having a significant number of vessel categories adds complication to the levy	**5**
Crew on the vessel	Accreditation levels, e.g. discounts for higher maritime accreditations, SeaCert level, accreditations from different countries	**2** Crews with higher accreditation may have more experience in the maritime environment, lessening their chance of an incident	**0** No relationship between crew accreditation and the impact of an incident	**1** Challenging, because a vessel would not always have the same crew	**3**
Safety features/	Different rates for different vessel	**2**	**0**	**2**	**5**

Risk Factor	Possible Measures	Risk Alignment (0,1,2,3)		Ease of implement-ation (3 good, 1 bad)	Total Score
		Likelihood	Impact		
accreditation of the vessel	safety management systems, e.g. MOSS, SOP, safety case etc.	Vessels with more advanced safety systems may be less likely to be involved in an incident	If an incident occurred, the rating of the vessel would have no relationship to the impact	Relatively easy to collect with vessel registration.	
Passengers carried on the vessel	Passenger charge for sum of passengers carried over certain period of time	**1** The number of passengers on board has a minimal relationship to the chance of an incident	**3** The more passengers and crew on board, the more lives at danger	**1** Would require extensive monitoring to acquire accurate actual passenger numbers	**5**
	Charge per vessel Pax Cap	**1** Same as above	**2** Same as above, except vessel capacity is only an estimation, so not as closely related to impact as actual passenger numbers carried	**3** Already collected	**6**
Carrying freight	Sum of freight weight carried per trip	**1** There is only a small relationship between weight of freight and likelihood of an incident	**3** More freight has a larger impact, both financially as in lost freight, and also the chance of damaging other vessels, infrastructure and environment	**1** Keeping track of actual freight carried would require extensive monitoring.	**5**
	Vessel DWT capacity	**1** Same as above	**2** Same as above, but DWT is only an estimation of the weight a vessel may be carrying	**3** Already collected	**6**

Risk Factor	Possible Measures	Risk Alignment (0,1,2,3)		Ease of implement-ation (3 good, 1 bad)	Total Score
		Likelihood	Impact		
Type of freight	Rates per DWT for different types of freight, e.g. cars, produce, waste, oil	**0** No relationship between type of freight and chance of accident	**2** Possible relationship between the impact of freight, e.g. oil more likely to have large impact on marine environment	**1** Would require extensive monitoring	**3**
Type of activity	Fishing, recreation/tourism , transportation	**1** The type of activity by itself is not highly related to likelihood – but it may be a representation of other likelihood factors like time on water and location of vessel	**1** Again, the vessel activity itself is not related to impact, but it may represent other impact factors like size of vessel and number of passengers	**2** Possible to obtain on vessel registration, but not all vessels may fall into a single category, and adding multiple categories increases complexity	**4**
Length of time on water	Sum of hours/days spent on water (domestic)	**3** Length of time on water is highly related to likelihood of an incident	**0** Length of time has no correlation with the impact of an incident	**1** Very difficult to collect, would require extensive monitoring.	**4**
	Sum of scheduled time on water / planned/ average, e.g. passenger ferry timetable (domestic)	**2** May be a relatively well aligned indicator of time on water	**0** Same as above	**2** Slightly easier to collect, vessels could submit planned schedules, however still requires extensive administration and could be abused (e.g. people not submitting accurate schedules)	**4**

Risk Factor	Possible Measures	Risk Alignment (0,1,2,3)		Ease of implement-ation (3 good, 1 bad)	Total Score
		Likelihood	Impact		
	Charged only for periods when vessel has been active (e.g. monthly charges or rebates) (domestic)	**2** Reflects extensive periods when vessel hasn't been active, but is not an accurate reflection of the time the vessel has spent on the water in a single month.	**0** Same as above	**3** Should be relatively simple for a vessel to apply for a rebate.	**5**
	Port Visits (foreign)	**3** Well aligned with time in New Zealand waters	**0** Same as above	**3** Already collected	**6**
	Per entrance to NZ waters (foreign)	**2** Doesn't reflect how long vessel actually spends in NZ	**0** Same as above	**3** Less detail than what is already collected	**5**
Distance from shore/ type of waters	Different rates for vessels that operate within restricted limits, within coastal limits and beyond coastal limits	**2** Being further from shore and in more dangerous waters would increase likelihood of an incident	**1** Where a vessel is travelling has a relatively minimal relationship to potential impact of an incident	**2** Not currently used as a category, may increase categories and complexity	**5**
	Different rates for SOLAS vessels (or vessels that meet the SOLAS safety requirements) (domestic)	**2** Ships that meet SOLAS requirements can travel on international voyages or beyond restricted limits	**1** Same as above	**3** Currently used/ easy to collect at registration.	
	Different rates for domestic vs foreign vessels	**2** Foreign vessels have to travel from international waters, which are more	**1** The impact of an accident could be as serious regardless of where the	**3** Already collected	**6**

Risk Factor	Possible Measures	Risk Alignment (0,1,2,3)		Ease of implement-ation (3 good, 1 bad)	Total Score
		Likelihood	Impact		
		exposed and likely to have rougher waters etc.	vessel is and whether it is domestic or foreign		
Going out during an extreme weather warning period	Surcharges for operating in certain extreme weather warning conditions	**3** Travelling in some weather would significantly increase the likelihood of an incident	**0** No relationship to incident impact	**1** Very difficult to monitor and administrate.	**4**

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